FURTHER POINTS OF VIEW TO THE LIMNOLOGICAL EVALUATION OF THE „FERTŐ"-TYPE SHALLOW LAKES

by

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Abstract

The author carried out systematical hydroecological investigations during many years (1971—76) extended also to the invertebrate macrofauna on helophytes as well as submersed phanerogames of the southern part of Lake Fertő/Hungary. He summarizes the most significant results in the hope that he may give funther points of view by their confirmation to the limnological characterization of the "fertő"-type shallow lakes (Varga 1954).

Introduction and objective

As a result of the planned researches a considerable amount of special literature was piled up in the past years on Lake Fertő. From the Austrian part also a work of summarizing character was elaborated (Löffler 1974, 1979) on the limnology of Lake Fertő.

In connection with the hydrobotanical researches for example they pointed out the excelling ecological importance of the wind (Tóth — Szabó 1962) Numerous authors (as Donászy 1975, Stehlik 1972, Szabó 1962) stated the most important hydroecological differences between the reeds and the open-water subsystem.

At the beginning of the seventies in course of comparative zoological investigations of the different hairweed tangly stands it has been elucidated that there exist marked ecological differences between the so-called isolated and the open-water hairweed tanglies. The biotopes of the two types offer living conditions to differing invertebrate macrofaunae (Andrikovics 1973).

In the course of the specialized detail researches several features of the general hydrobiological character of the lake were revealed furthermore Varga (1954) set up the category of the "fertő"-type lakes even on the basis of his researches on Lake Fertő. His definition of the "fertő"-type

reads: "the fertős (plural of the Hungarian word "fertő") are very shallow standing waters of larger extension show both from the physico-chemical as well as from the biocenotical points of view a labile balance out of measure."

The attitude of the excellent characterization of V a r g a is today still modern thus proceeding from it we may group our sorrowfully few data, from the other side we may embed in appropriate frame the future agenda within the hydrobiological researches of Lake Fertő.

The aim of the present study is the publication of some more general hydrobiological conclusions by the detail results of the hydrobiological researches systematically carried out on the southern part (i.e. the Hungarian territory) of the lake respectively by the conclusions drawn on basis of them.

Location, date and method of the hydrobiological researches carried out on Lake Fertő

The acquaintance of the location of collectings, the time intervals and the principal methodical references is inevitably necessary for the better understanding and stating of their generalizational level of the conclusions.

The main objective of the investigations was the comprehensive synbiological study of the aquatic invertabrate macrofauna (approximatively 1 – 20 mm in size order). We carried out the investigations and the measurings of the additional physico-chemical pecularities from the sediments of 11 characteristic tanglies, several reeds, bulrush resp. sedge stands and open-waters of the southern (i.e. the Hungarian) part of the lake. In the tanglies we carried out mainly aproaching-quantitative collectings. Our approaching-quantitative invertebrate macrofauna investigations were carried out in 1971 – 72, the quantitative investigations however in 1975 – 76. In the passed interval we made yearly twice field excursions which assured the continuity between the two collectional series.

From the hydrophysical and chemical factors we investigated those the impact of which were the most significant to the zoogenous factor – according to our knowledge. These were: water temperature, pH, conductivity and dissolved O_2. Occasionally we determined the presence of H_2S originated in the mud.

In course of our zoological investigations we collected parallelly larvae and imagines too and the quantitative collecting method was in general more modern than otherwise adapted in the hydrozoology. After heaving into the water a prism of 50 by 50 cm ground space, depending from the water depth covered by a nylon net (No. 25 mesh) being generally 100 cm high, on the limiting surface of the mud – water reaching in from the outside a frogman cut the plant stalks with a strong lawn-shear. Finally we analyzed the intestinal content of the frequent *Ephemeroptera*, *Odonata* and *Trichoptera* larvae in order to sketch the principal feed relations.

The main generalizable hydrobiological results

As a consequence of the frequent wind-effect mosaicity of only small extent may develop on Lake Fertő especially on the open-water parts. The intensive effect of the wind presumably may significantly interact that in the open-water tangle stands a zoocenosis poor in species only may settle.

In windless weather nevertheless significant dissolved O_2 differences are demonstratable in the fairy-rings consisted of *Potamogeton pectinatus* and of only several square meters extension – being a characteristic formation of Lake Fertő – between the intensively photosynthtizing outer and the decaying inner part. Table I.

Table I

Hidroecological investigation of a Potamogeton pectinatus polycormon
(11 o' clock, 27 Jun, 1975, Bay of Fertőrákos)

	Open water	Edge of the polycormon	Inside of the polycormon
Number of measurements	3	3	3
Water temperature C	26.4	26.2	27.9
Dissolved oxygen (mg/l)	7.85	11.38	9.41

The submersive phanerogames of Lake Fertő are according to their topographical location transitional biotopes between the open-water and the emergent macrovegetation i.e. helophytes. The principal manifestation of their transitional character is that their water-climate differs from the reeds as well as from the open-waters too.

In the tanglies the dissolved O_2 values – according to the measurings carried out in monthly frequency – manifested in general great saturation values, we found rarely small values only in single isolated tanglies.

We carried out day-sectional measurings in isolated stands of the *Utricularia vulgaris* being frequent in the reedy zones (Andrikovics 1978). According to their results the nocturnal oxygen insufficiency may be frequent especially in decaying stands. We may face often significant and long-lasting O_2 deficiency especially in the destructional period of the aquatic vegetation what affects decisively the quantitative and qualitative basic aspect of the invertebrate macrofauna.

In the reedy zone however when calm weather we found in any section of the day extremely low dissolved O_2 values what indicates a permanent O_2 deficiency and H_2S generation in the central part especially of the several kilometers wide reed. In course of the several years lasting collecting activity we demonstrated from Lake Fertő 136 macrofaunal taxons, the plurality of the species occur also in waters of other terriories

(Andrikovics 1979). All these investigations indicate that similarly to the *Rotatoria* (Varga 1934) primarily cosmopolitan macrofaunal species found their living conditions in Lake Fertő.

From the beginning of our investigations (1971) we noticed the rapid alteration of the macrofaunal extension as well as composition. The most dynamic and simultaneously the most ponderous factor from the zoological point of view too was the regression of the tangle-stands in front of the reeds. The distribution of 4 most important tangle species in defferent years and in singular lake-parts we summarized in Table II.

From the table it is clearly readable that beginning with the 1975–76 years the tangle stands are repressed gradually and the lake becomes by the end of the seventies almost tangle-free. The only exception are the stands of the *Najas marina* which progressed between 1974–76.

In the northern (i.e. Austrian) part of the lake a similar change occurred between 1970–76, the open-water *Myriophyllum spicatum* and the *Potamogeton pectinatus* disappeared almost entirely till 1976 (Schiemer 1978).

Already the approching-quantitative macrofaunal investigations carried out between 1971–72 justified that the fauna of the open-water *Potamogeton pectinatus* and *Myriophyllum spicatum* stands is qualitatively discrete and manifold. Nevertheless we could not demonstrate species living only consequently in stands of the *Potamogeton pectinatus* or *Myriophyllum spicatum*.

The principal vegetal stands of the isolated great lakes (as e.g. Herren Lachen = Pond Herlakni), the *Potamogeton pectinatus*-association is populated by an invertebrate macrofauna quantitatively more rich than the previous. Similarly to the open-water tanglies we may consider here too the almost entire absence of leaches, snails, water asellids (sow bugs) and aquatic bugs. In the isolated small lakes 3 submersive phanerogam species formed a facies: the *Potamogeton pectinatus*, the *Utriculatia vulgaris* and the *Najas marina*. The most frequent and most peculiar stand was that of the *Utricularia vulgaris*. From this stand we found invertebrate macroorganisms considered as pelocol in great quantities.

The invertebrate macrofauna of the *Najas marina* is remarkably poor, in turn the number of the species living also in the pop-weed is large. The informational investigations have shown the macrofaunae of the emergent macrovegetation as well as the mud to be poor.

In the second half of the seventies the hydrobotanical situation changed in large extent. The depression to the background of the open-water tanglies, of the stands of *Utricularia vulgaris* resp. the progression of the emergent macrovegetation and between 1974–76 of the stands of *Najas marina* caused an extensive faunal pauperization by the turning into unfavorable of the living conditions.

The result of the quantitative investigations to be alleged in next illustrate well their size, extent.

From *reeds standing in water* we could demonstrate all together only 43 taxons. The individual number of the macrofauna altered between

Table II

The occurance frequent weeds at the Hungarian part of Lake Fertő

	1971			1972			1973			1974			1975			1976			1977			1978		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Potamogeton pectinatus	●	●	●	●	●	●	+	●	●	–	●	●	–	●	●	–	+	+	–	–	–	–	–	–
Myriophyllum spicatum	●	●	–	+	+	–	+	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–
Utricularia vulgaris	–	–	●	–	–	●	–	–	+	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–
Najas marina	–	–	●	–	–	●	–	+	●	–	●	●	–	●	●	–	●	●	–	+	+	–	–	–

Legends: 1. open lake, 2. isolated large ponds, 3. isolated little ponds, ● frequent, + found, – very rare

270 – 1704 individua/m². The most frequent total individual number was about 600 – 800 ind/m².

From the *bulrush stands* individua of 33 taxons were recoverd with marginal values of 776 – 1748 ind/m². The individual number data mostly exceeded the magnitudinal order of a thousand.

From the *submerged stands* we investigated systematically the *Potamogeton pectinatus* fields of the Pond Herlakni. From here we demonstrated 31 taxons with individual number of 3775 – 9972 ind/m². Most frequently values of above 4500 ind/m² were found. As a comparison we investigated the *Najas marina* stands of Pond Herlakni. Here the individual number was all together 640.

The sediment investigations have shown that the invertebrate macrofauna is poor in the open-water mud, empty mud-grips often happen. In quantitative aspect Lake Fertő offers – in comparison to the eutrophic Polish lakes – living conditions to a poorer invertebrate macrofauna on helophytes as well as submersive phanerogams.

On basis of the common experiences of the intestinal (gut) content investigations as well as the quantitative macrofauna collectings carried out on macrovegetational areas of Lake Fertő, it is to state that the species number of the organisms known as detrivorous and algivorous is the greatest in the biotopes. On the other hand the species and individual number of organisms consuming living plantal particles indicates that the periphyton connected to the macrovegetation has as nutritive stock the greatest significance to the consumption of the invertebrate macrofaunal elements. The most importans food basis of the predators is the great quantity of the *Chironomidae* larvae.

Summarizingly we may state that we may characterize the invertebrate macrofauna of the "fertő"-type lakes – best known from the denominative representant – in first line by variable communities of well-known species of Hungary's fauna. Their quantity is often less than expected since to prevent the often unfavorable hydroecological conditions only the euryecious and dynamic species are able.

The bacterial decomposition has primary role in the decompositional process of the primary production (Imhof-Burian 1972), the greatest part of the produced organic matter however does not return to the water even as the result of the bacterial activity, thus the "lake" passes more and more its place to the hemiaquatic, later on to the terrestric biotopes.

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